

## Example 2a: The Quadratic Formula

**Note:** You must be using the paid version 2.0.0 or later to use macros.

Problem: Use the Quadratic Formula to solve the following quadratic equations

<u>a</u>	<u>b</u>	<u>c</u>	<u>x1</u>	<u>x2</u>
3	6	-24	?	?
1	2	1	?	?
3	-6	24	?	?

Step 1:

Solve the first equation using normal calculator operations



Notice that we've used + instead of  $\pm$  and multiplied the radical by 1. This is going to make our lives easier in a few minutes.

Step 2:

Turn the equation from step 1 into a macro by selecting it and choosing macro from Pg 2/2 of the selection toolbar.

You've now entered macro mode. You see your selected equation enlarged, the selected answer is shrunk, and everything else on your stack is hidden. Most buttons are now disabled.

# Acron RPN Calculator: Using Macros

## Step 3:

There's a few new things to notice in this macro that weren't present in the Pythagorean Theorem example. For starters, notice that the -6 is highlighted in yellow and the positive 6 is highlighted in green. Acron RPN has recognized that these values match and grouped them together. Try changing either of these 6's - you'll notice that the other automatically changes too. The same happens for the two 3's.

The other thing to notice as you are entering values is that you are asked to fill in values for the 2 and 4. These are constants and we never want to change them. Let's select each and hit 'freeze' from the toolbar. The background turns white and we will no longer be prompted to fill in these values.

## Step 4:

Not being asked to fill in the 2 and the 4 is convenient, but we are still being asked to fill in the 'a' and 'b' values twice. Plus we have to remember that the first 6 is really -b, so we have to be careful entering it. Let's freeze the first '-b', and the 'a' in the denominator. Notice as we change the unfrozen 'a' and 'b' values, the frozen ones still update.

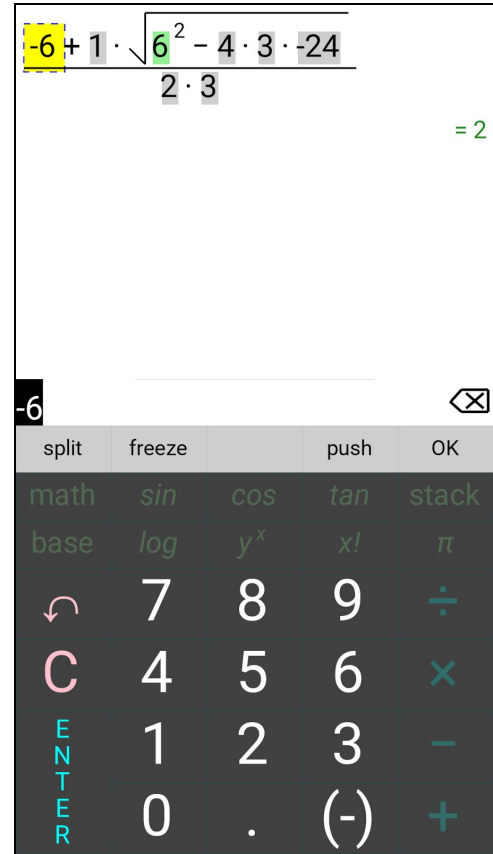
## Step 5:

You should now have four unfrozen values: a single copy of 'a', 'b', and 'c', plus the 1 that multiplies the radical. Let's find the other solution to line 1 of our table by replacing the 1 with -1. We've found that the other answer is -4. Let's push that to the stack.

## Step 6:

Now we can solve line two in our table. As we enter the new 'a', 'b', and 'c', notice that these are not being grouped with the other 1's and 2's in our equation. This is because grouping is based on the original equation, not its updated values.

When we flip the sign of the 1 multiplier for this equation, we find that we get the same answer. Thus, the only answer to this quadratic equation is -1. Let's push that to the stack.



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### Step 7:

As we fill in line 3 of our table, notice that our macro has no trouble with imaginary roots. Let's push these to the stack too, and hit OK to close the macro.

### Helpful Hints:

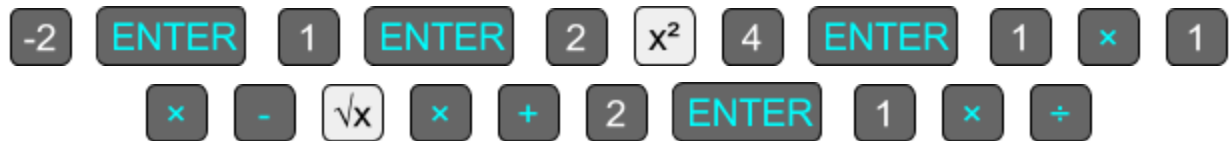
When you freeze a number, it will no longer be selected as you press ENTER or UNDO to change active cells. However, you can still tap frozen cells to select them, and from there either modify them or hit freeze to unfreeze them.

## Example 2b: The Quadratic Formula Revisited

In Example 2a, we conveniently chose values for 'a', 'b', and 'c' that wouldn't conflict with the other values in the formula. When Acron RPN grouped matching values, we wanted all of these values to be kept in sync. But what if we had started with line 2 of the table?

### Step 1:

Solve the second equation using normal calculator operations



### Step 2:

Now when we enter macro mode, we'll immediately notice things aren't working correctly. The -2 and 2 that are b's are highlighted together, but so is the 2 in the denominator. If we change the b's now, the 2 in the denominator changes too. To fix it, select the 2 in the denominator and hit 'split'. You'll notice that the other two 2's will no longer have a green background. This 2 is now no longer considered part of the group. We can now freeze it so that we'll no longer be prompted.

### Step 3:

We have a similar problem with the 1's. The 'a', 'c' and the radical multiplier have all been grouped. Select the radical multiplier and split it. Select the 'c' value and split it. Now when you select one of the 'a' values, only the other 'a' value should be selected. Now we can freeze the '-b' at the start of the formula, the 4 constant in the radicand, and the 'a' in the denominator.

### Step 4:

Finally we can proceed using our macro like Example 2a.

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### Helpful Hints:

When choosing initial values for an equation you plan on using as a macro, avoid numbers that accidentally match. Acron RPN always assumes that matching numbers are intentional, and you will have to use split to fix them. Remember that it is okay to have accidentally matching values when you are using a macro, you just need to avoid them when creating the macro.

You cannot reverse splitting two values. Your only remedy is to exit macro mode and start over. You can reverse freezing a value by tapping it to select and hitting freeze.

Splitting and freezing have no lingering effect after closing macro mode. The steps we've gone through to perfect our quadratic formula macro are probably only worth the effort if we plan on pushing a lot of results prior to exiting macro mode.